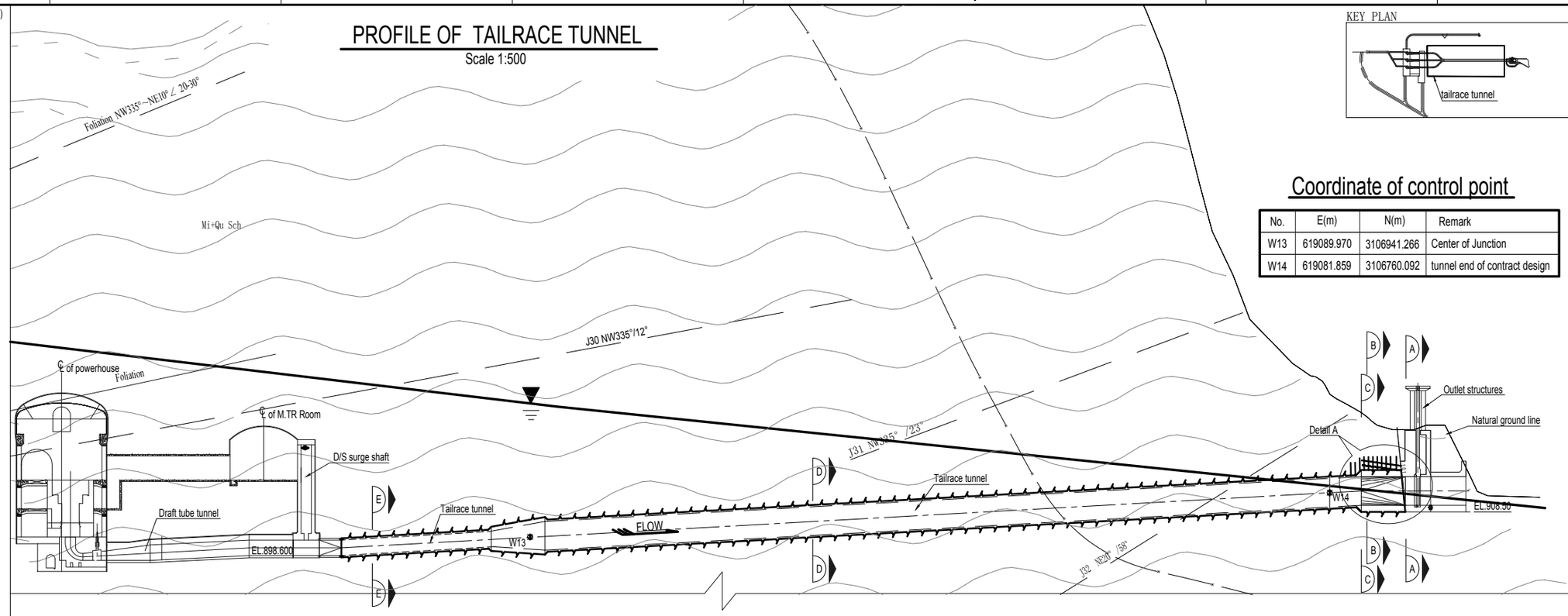
PROFILE OF TAILRACE TUNNEL

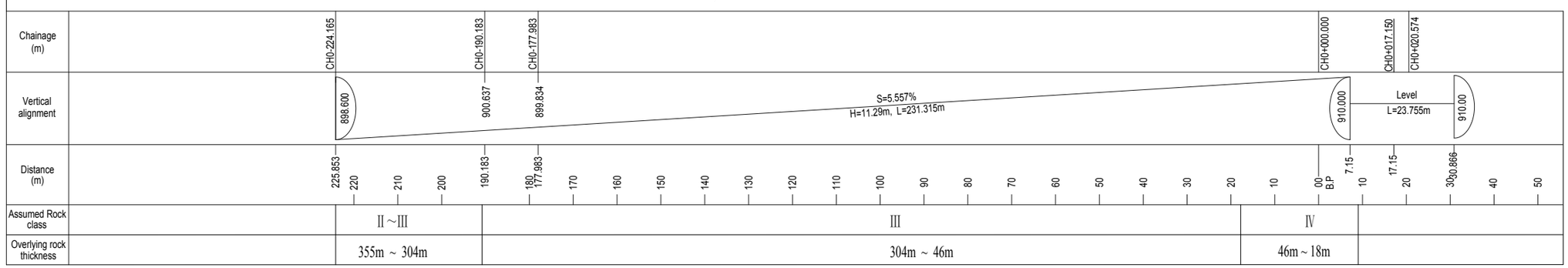
Scale 1:500



KEY PLAN

Coordinate of control point

No.	E(m)	N(m)	Remark
W13	619089.970	3106941.266	Center of Junction
W14	619081.859	3106760.092	tunnel end of contract design



TUNNEL SUPPORT PATTERN(D-D)

Rock mass quality	40≥Q	10≤Q<40	4≤Q<10	1≤Q<4		Q<1
Support type	I	II	III	IV (Without steel support)	IV (With steel support)	V Same as type IV(With steel support)
Inner dimension(m)	R=3.25m					
Excavation Parameter						
ESR	1.6	1.6	1.6	1.6		1.6
Excavation span(m)	3	3	2	1.5		0.5~1
Calculated MUS*(m)	13	10	6	4		2
MUS* for shotcrete application(m)		10	4	1.5		2
MUS* for rock dowel installation(m)		6	4	3		0.5~1
MUS* for steel support installation(m)					0.5~1.0	0.5~1
Excavation method	Blasting			Blasting/mechanically		Mechanically
Initial support parameters						
Weep hole, Φ50mm,L=0.3m	where necessary					
Plastic fiber shotcrete,f'c=25MPa	Spot	T=50mm	T=80mm	T=100mm	T=160mm	For class V rock, the same support scheme as class IV rock can be adopted after grouting is used to improve the integrity and firmness of surrounding rock.
Rock dowel, D25,L=3m,alternately	Spot	@2.5m×2.5m	@2m×2m	@1.5m×1.5m	@1m×1m	
Steel support, MB150 (or lattice girder)					where necessary	
Forepoling grouted dowel,D25mm, @400mm, L=6m					where necessary	
*MUS , Maximum Unsupported Span.						

TUNNEL SUPPORT PATTERN(E-E)

Rock mass quality	40≥Q	10≤Q<40	4≤Q<10	1≤Q<4		Q<1
Support type	I	II	III	IV (Without steel support)	IV (With steel support)	Same as type IV
Inner dimension(m)	R=1.75m					
Excavation Parameter						
ESR	1.6	1.6	1.6	1.6		1.6
Excavation span(m)	3	3	2	1.5		0.5~1
Calculated MUS*(m)	13	12	6	4		2
MUS* for shotcrete application(m)		12	4	2		2
MUS* for rock dowel installation(m)		6	4	4		0.5~1
MUS* for steel support installation(m)					0.5~1.0	0.5~1
Excavation method	Blasting			Blasting/mechanically		Mechanically
Initial support parameters						
Weep hole , Φ50mm,L=0.3m	where necessary					
Plastic fiber shotcrete,f'c=25MPa	Spot	T=50mm	T=50mm	T=80mm	T=160mm	For class V rock, the same support scheme as class IV rock can be adopted after grouting is used to improve the integrity and firmness of surrounding rock.
Rock dowel , D25,L=3m,alternately	Spot	Spot	@2m×2m	@1.5m×1.5m	@1m×1m	
Steel support, MB150 (or lattice girder)					where necessary	
Forepoling grouted dowel,D25mm, @400mm, L=6m					where necessary	
*MUS , Maximum Unsupported Span.						

NOTE

1. This set of drawings are for the layout drawings of trilrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. The excavation and support methods can be adjusted according to the actual situation after the geological conditions are revealed.
4. It is evident that the maximum unsupported span is a guideline, only, and needs continuous adjustment to the prevailing rock conditions and construction requirements at the spot.
5. The scope of this set of drawings is from CH0-225.853 to tunnel portal, the rest will be prepared after draft tube design is completed.
6. The forepoling is mainly used in the tunnel section with poor surrounding rock geology, which should be used together with dowel and steel support （or lattice girder）, and the spacing of dowel should be consistent with that of steel support.
7. The detail of weep holes, rock dowel, steel support and steel lattice girder see the drawing No. UT1-C-000-CVL-DG-40001.
8. Other see sheet 2.

Scale:
1:500 0 5 10 15 20 25m

LEGEND

- Gneiss
- Interbedded Mica Schist and Quartz-Schist
- Inferred boundry between moderately weathered and slight weathered
- Inferred lithology boundry
- Joint number and attitude（Dip direction/Dip
- Fault number and attitude（Dip direction/Dip）
- Inferred ground water level

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE.
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.G.

PROJECT TITLE
Upper Trishuli-1 HEP (216MW)

OWNER
NWEDC

OWNER'S ENGINEER
TRACTEBEL ENGIE　JADE CONSULT

CONTRACTOR
DOOSAN Doosan Heavy Industries & Construction

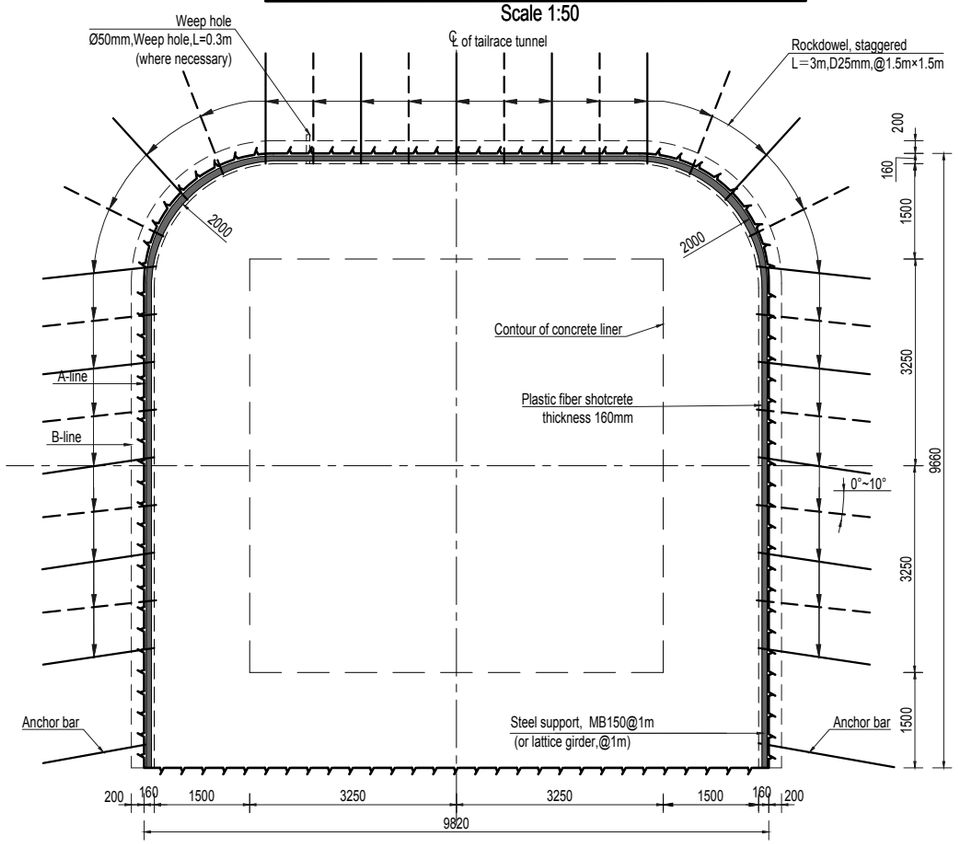
DRAWING TITLE
EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL (1/7)

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-01	1 OF 7	0A

A1 (594 x 936 MM)

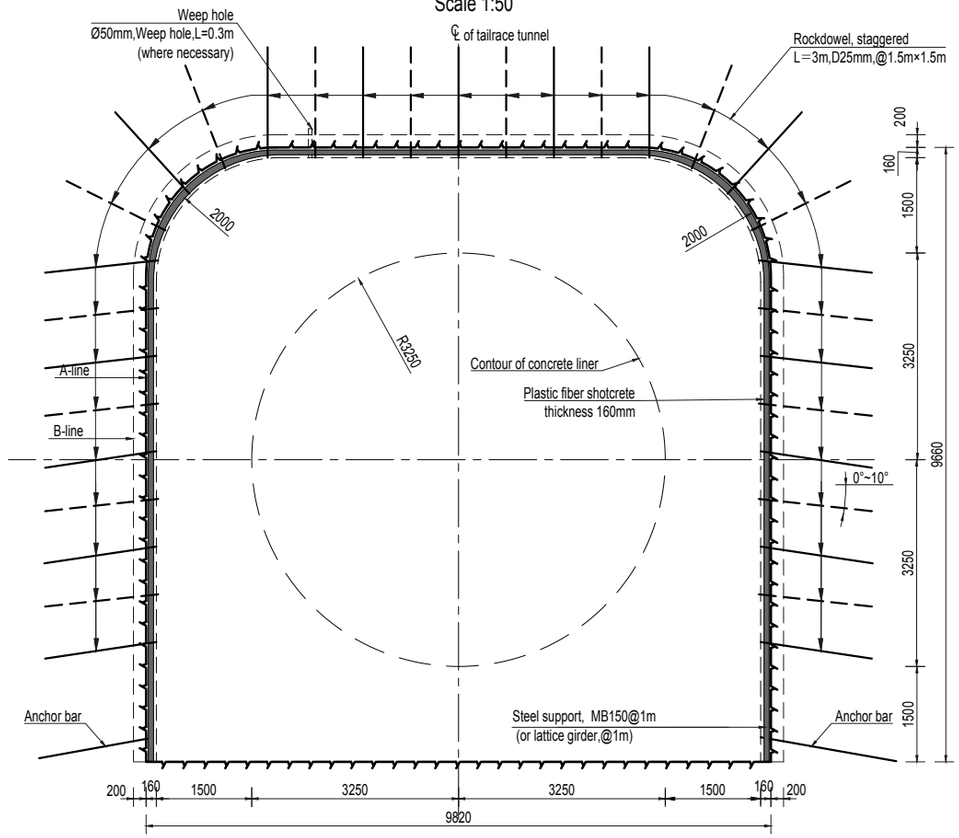
SUPPORT TYPE OF ROCK CLASS IV(SECTION A-A)

Scale 1:50



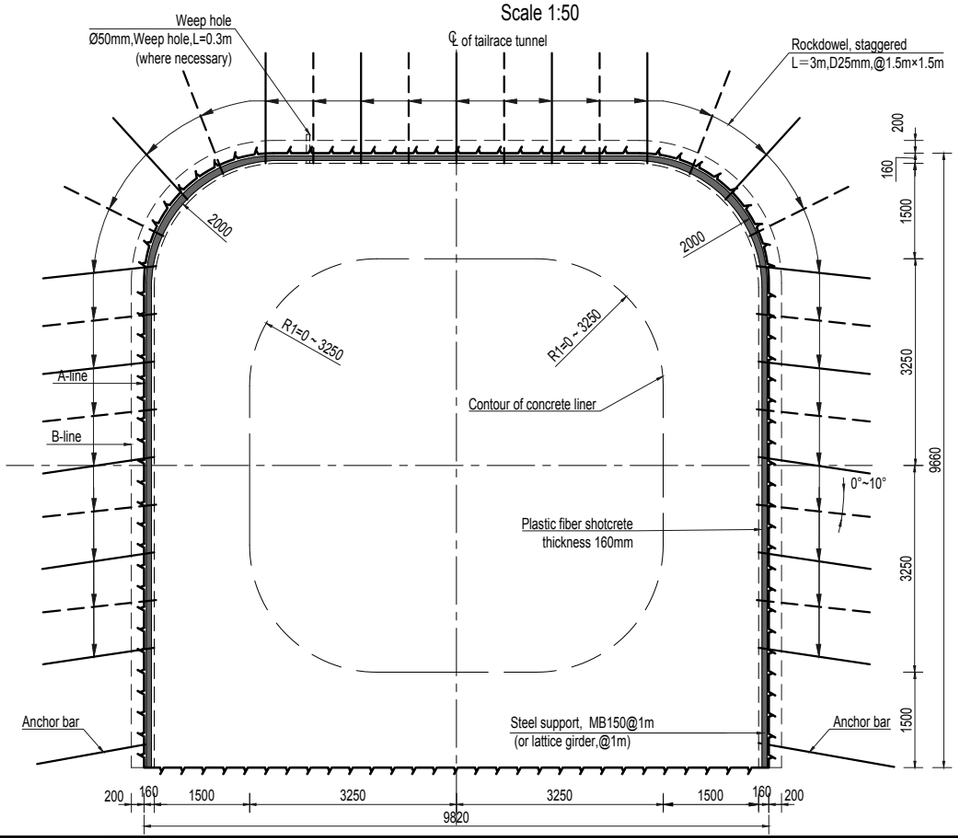
SUPPORT TYPE OF ROCK CLASS IV(SECTION C-C)

Scale 1:50



SUPPORT TYPE OF ROCK CLASS IV(SECTION B-B)

Scale 1:50



Note:

1.The outlet section of tailrace tunnel is a transition type. The change of the chamfer radius of the two corners on the top is as follows:

- The internal radius of the tunnel (R1) changes from 0 to 3.25m

2.The steel ribs at outlet are only required in rock class IV, number and distance of the steel ribs shall be determined by the site geological conditions.

NOTE

1. This set of drawings are the excavation and initial support of tailrace tunnel.
2. The cylinder specified compressive strength of shotcrete and cement mortar at 28 days of age is 25MPa.
3. The yield strength of steel is 250MPa.
4. Rust preventive compound will be sprayed on exposed surface of steel structure.
5. Symbol description:
   A-Line is the design excavation line.
   B-Line is the overbreak line.
   R denotes round bar, yield strength of the round bar is 280MPa.
   D denotes deformed bar, yield strength of the deformed bar is 500MPa;
6. See subsequent drawings for concrete structure and reinforcement.

Scale:
1:50 0 0.5 1 1.5 2 2.5m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE.
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.G.

PROJECT TITLE
Upper Trishuli-1 HEP (216MW)

OWNER
NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT.LTD.

OWNER'S ENGINEER
TRACTEBEL ENGIE
jade CONSULT

CONTRACTOR
DOOSAN Doosan Heavy Industries & Construction

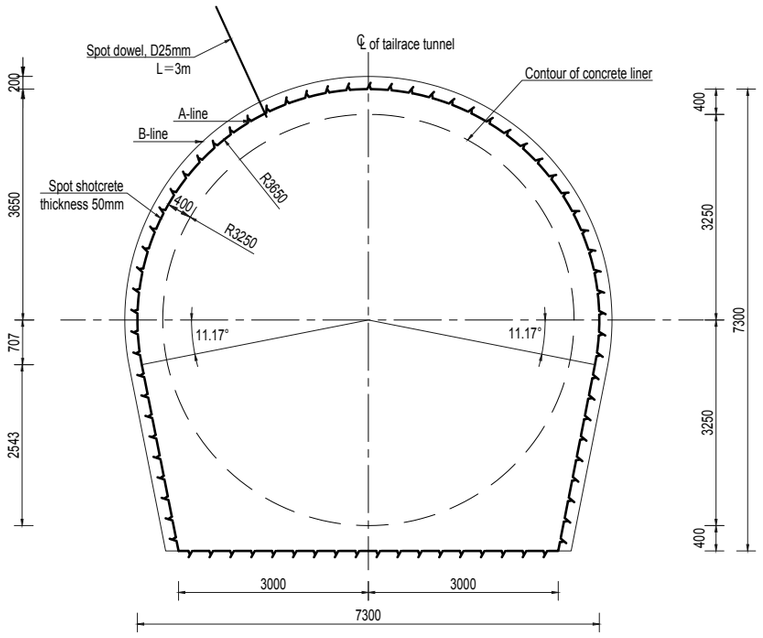
DRAWING TITLE
EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL(2/7)

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-02	2 OF 7	0A

A1 (594 x 841 MM)

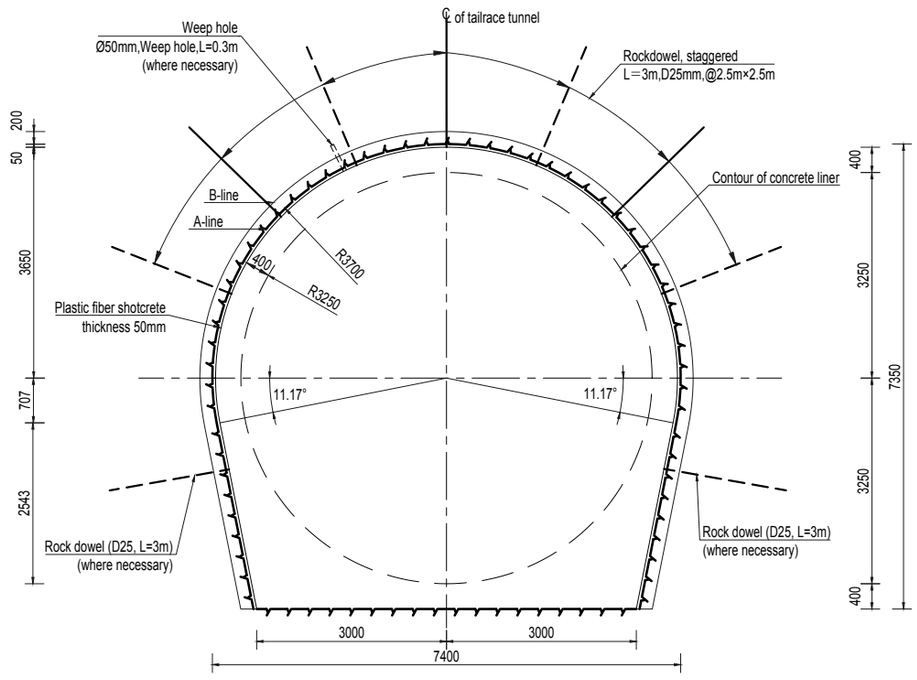
SUPPORT TYPE OF ROCK CLASS I

(SECTION D-D) Scale 1:50



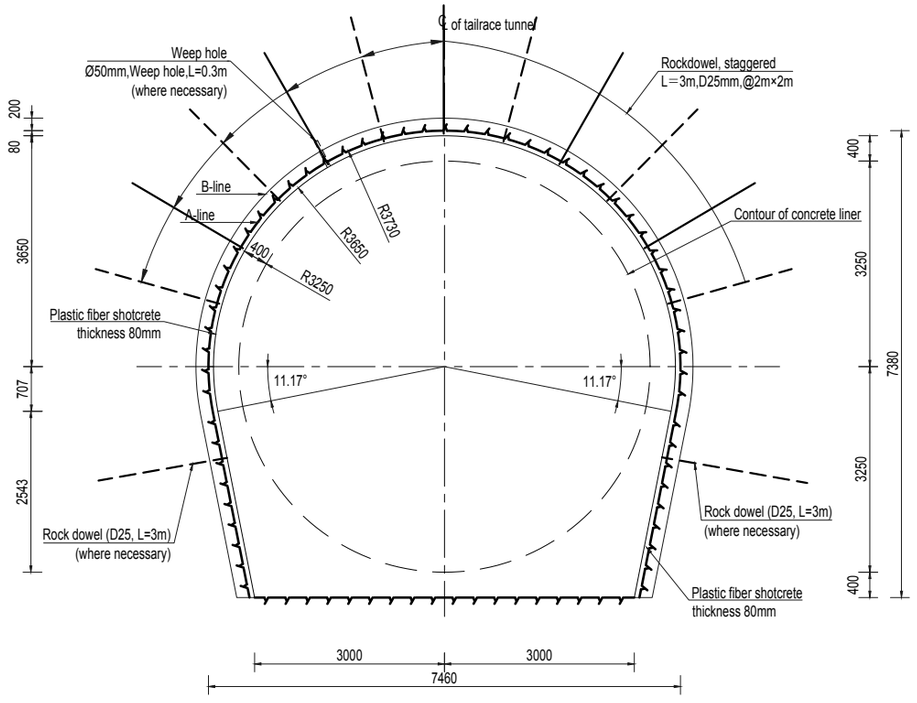
SUPPORT TYPE OF ROCK CLASS II

(SECTION D-D) Scale 1:50



SUPPORT TYPE OF ROCK CLASS III

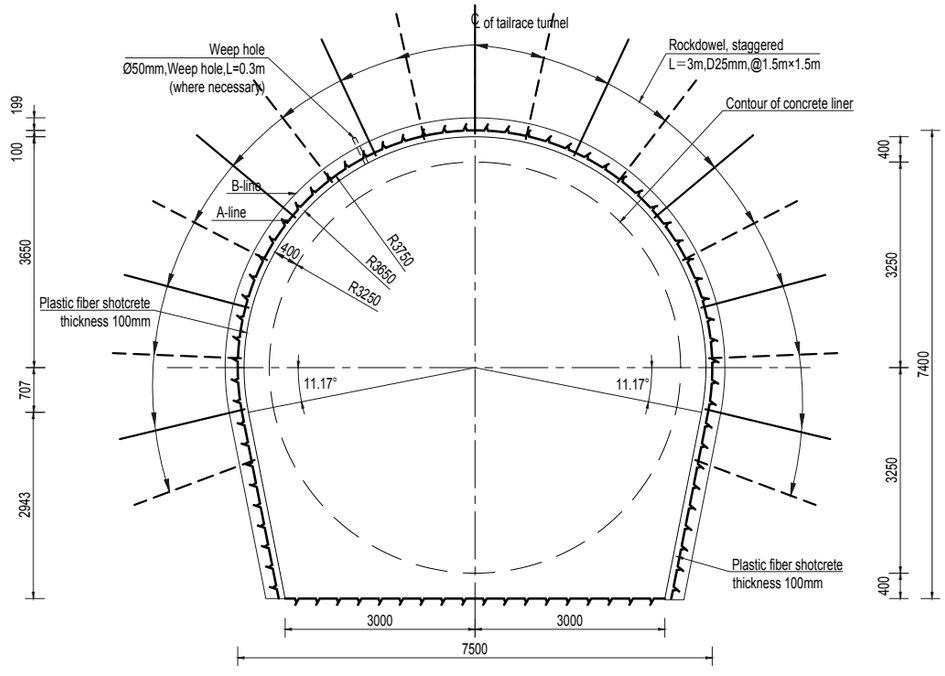
(SECTION D-D) Scale 1:50



SUPPORT TYPE OF ROCK CLASS IV

(WITHOUT STEEL SUPPORT)

(SECTION D-D) Scale 1:50



NOTE

1. This set of drawings are the excavation and support of tailrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 2.

Scale:

1:50 0 0.5 1 1.5 2 2.5m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE.
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.C.

PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER

NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT. LTD.

OWNER'S ENGINEER

TRACTEBEL ENGIE jade CONSULT

CONTRACTOR

DOOSAN Doosan Heavy Industries & Construction

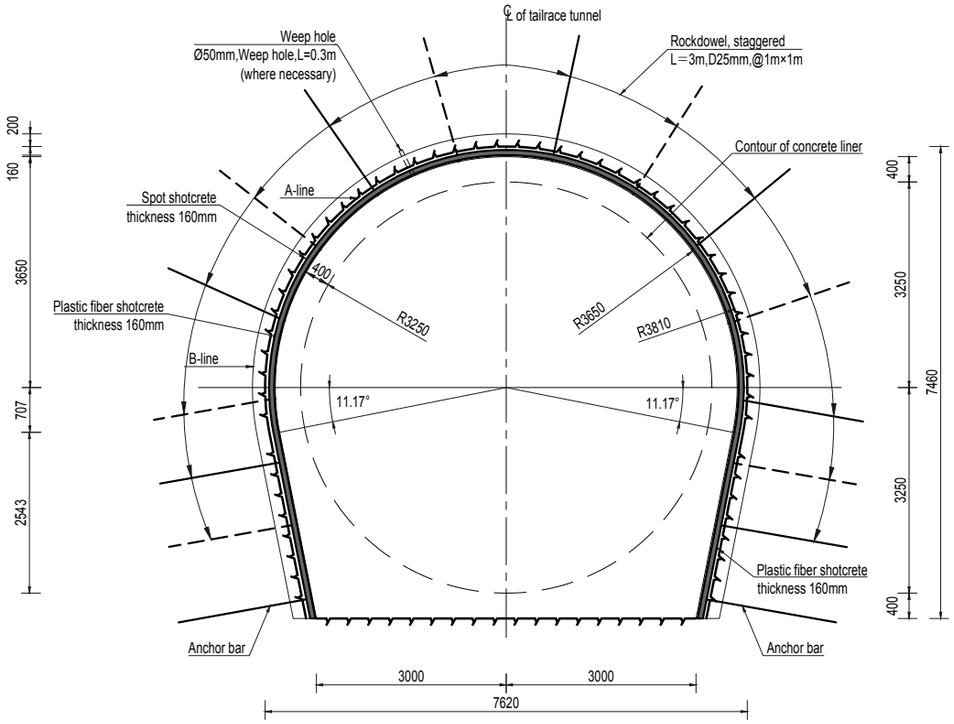
DRAWING TITLE

EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL(3/7)

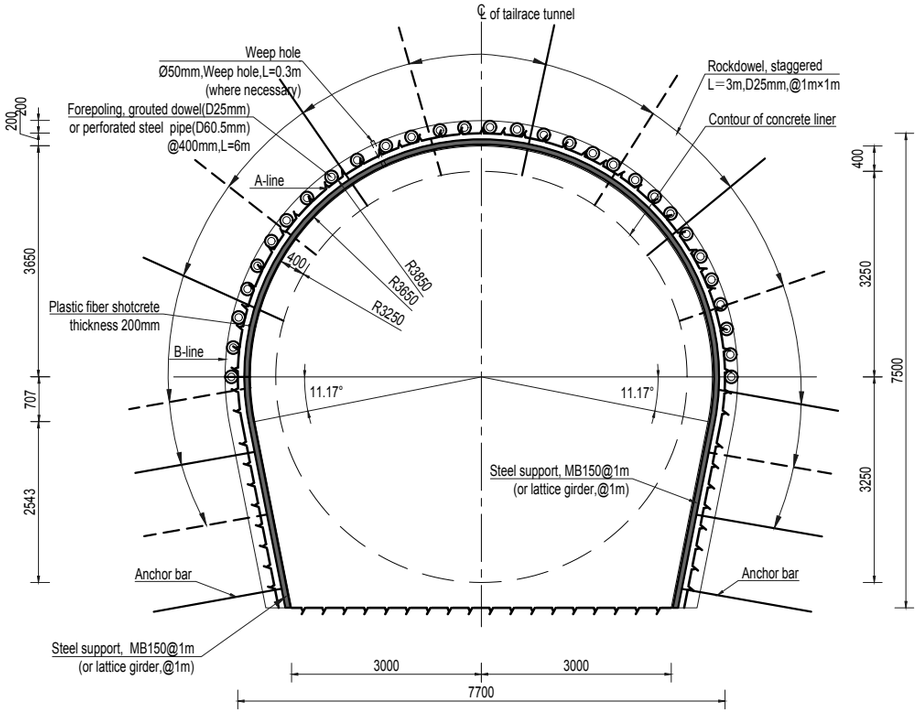
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-03	3 OF 7	0A

A1 (594 x 841 MM)

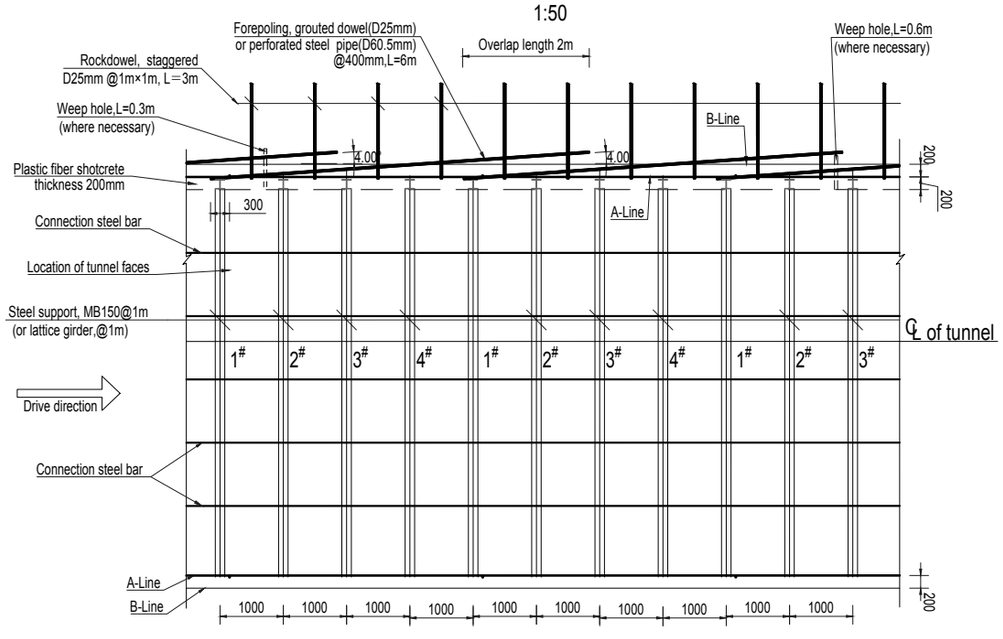
SUPPORT TYPE OF ROCK CLASS IV
(WITH STEEL SUPPORT)
(SECTION D-D) Scale 1:50



CROSS SECTION OF FOREPOLING
(SECTION D-D) Scale 1:50



LONGITUDINAL PROFILE OF FOREPOLING
1:50



NOTE: (1)The gaps behind the steel ribs need always be filled with shotcrete and/or concrete, not with rock blocks.
(2)The excavation profile may need to be adjusted to a "saw-tooth profile" and size of ribs/girders may also be adjusted.

NOTE

1. This set of drawings are the excavation and support of tailrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 2.

Scale: 1:50 0 0.5 1 1.5 2 2.5m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.C.

PROJECT TITLE
Upper Trishuli-1 HEP (216MW)

OWNER
NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT.LTD.

OWNER'S ENGINEER
TRACTEBEL ENGIE
jade CONSULT

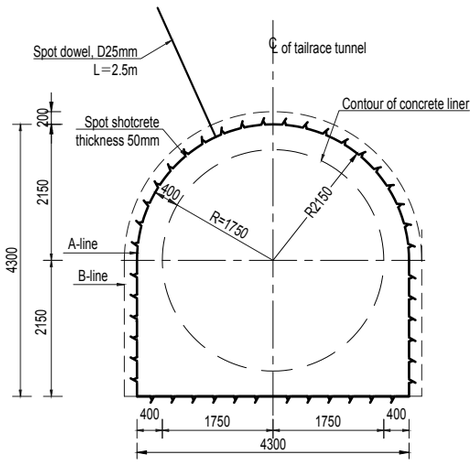
CONTRACTOR
DOOSAN Doosan Heavy Industries & Construction

DRAWING TITLE
EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL(4/7)

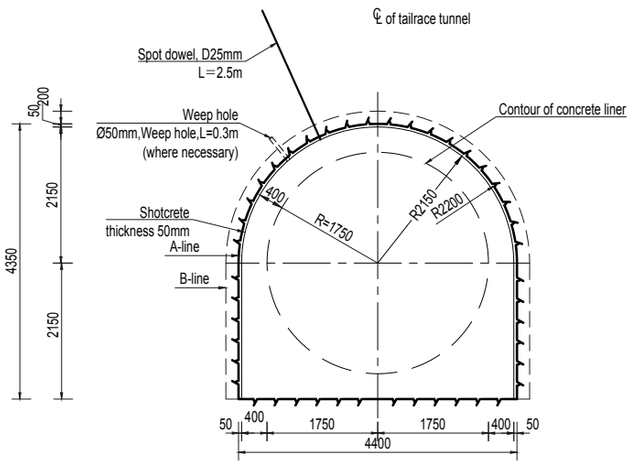
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-04	4 OF 7	0A

A1 (594 x 841 MM)

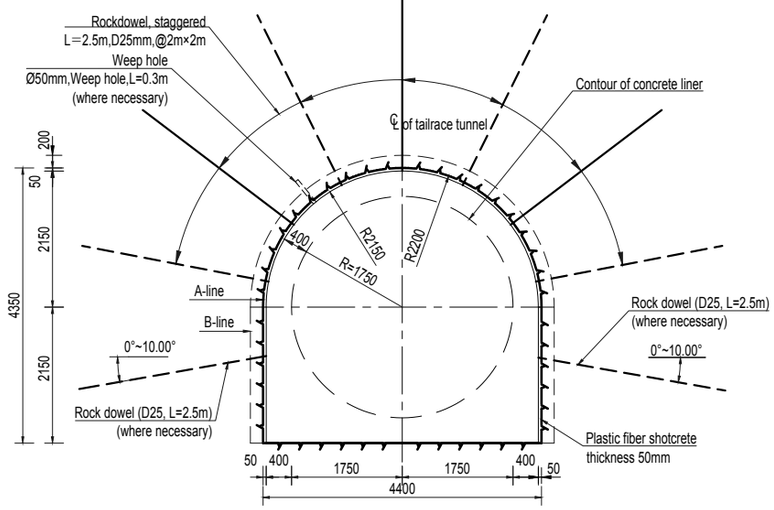
SUPPORT TYPE OF ROCK CLASS I
(SECTION E-E) Scale 1:50



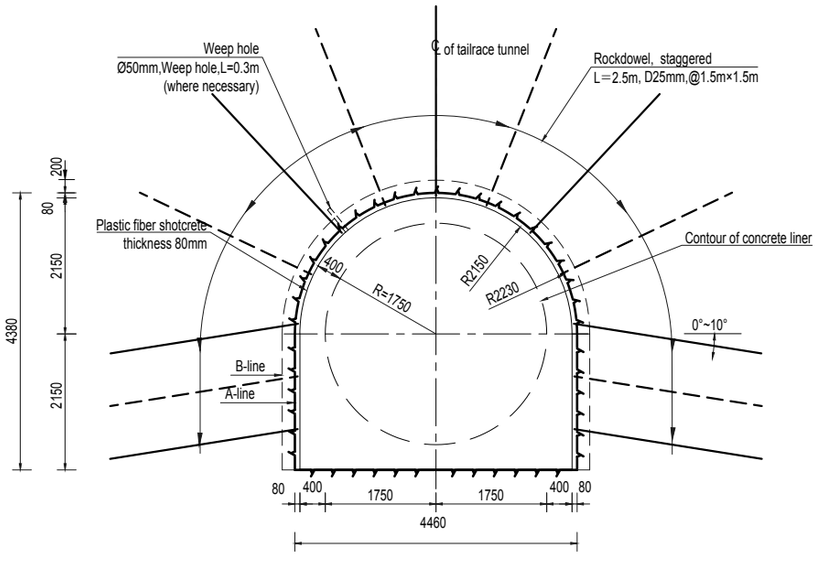
SUPPORT TYPE OF ROCK CLASS II
(SECTION E-E) Scale 1:50



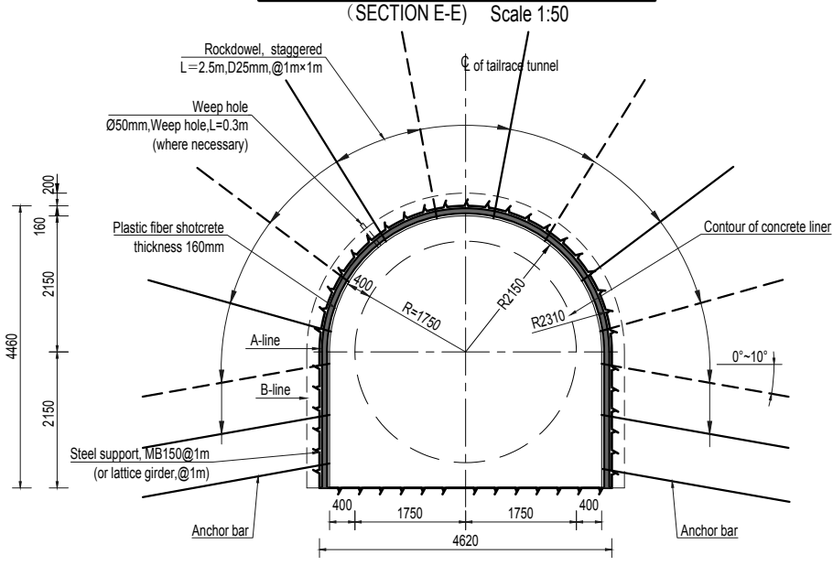
SUPPORT TYPE OF ROCK CLASS III
(SECTION E-E) Scale 1:50



SUPPORT TYPE OF ROCK CLASS IV
(WITHOUT STEEL SUPPORT)
(SECTION E-E) Scale 1:50



SUPPORT TYPE OF ROCK CLASS IV
(WITH STEEL SUPPORT)
(SECTION E-E) Scale 1:50



NOTE

1. This set of drawings are the excavation and support of tailrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 2.

Scale:
1:50 0 0.5 1 1.5 2 2.5m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.G.

PROJECT TITLE
Upper Trishuli-1 HEP (216MW)

OWNER
NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT.LTD.

OWNER'S ENGINEER
TRACTEBEL ENGIE
jade CONSULT

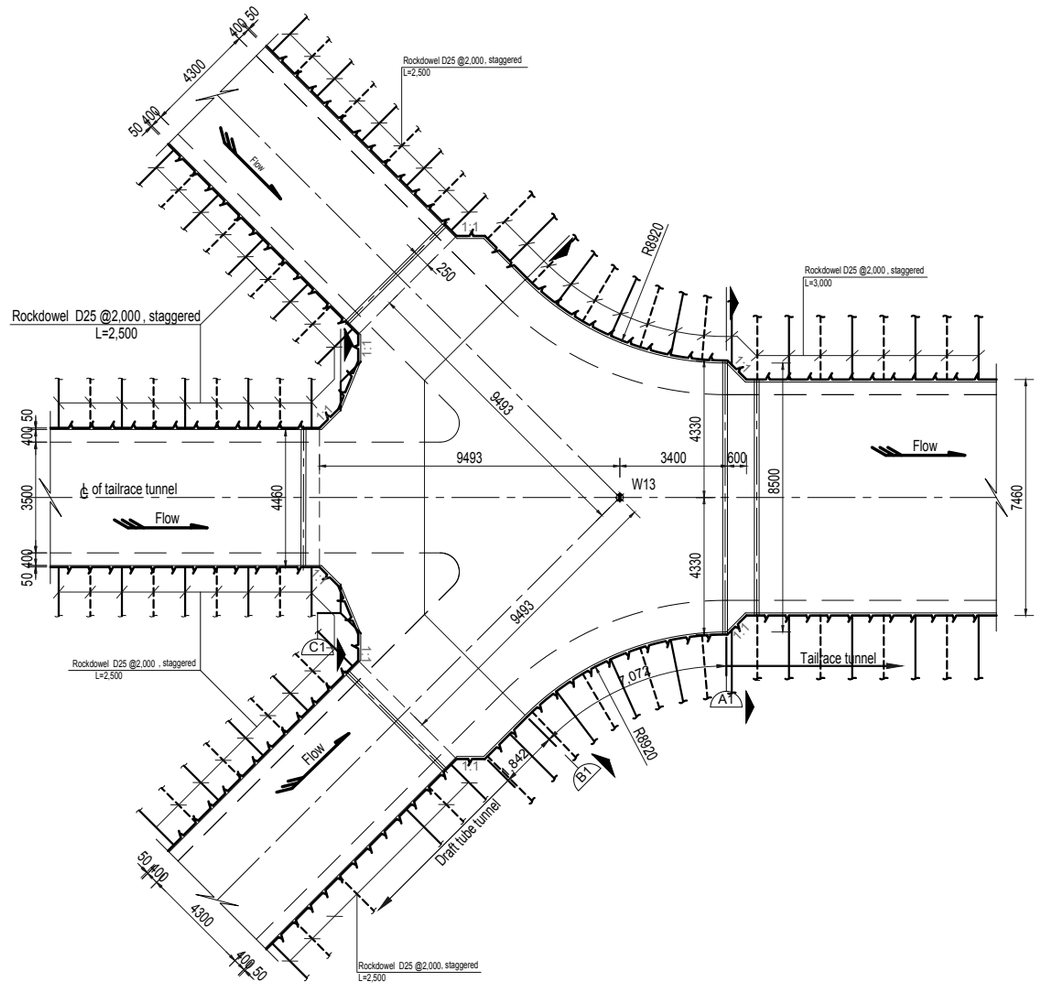
CONTRACTOR
DOOSAN Doosan Heavy Industries & Construction

DRAWING TITLE
EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL(5/7)

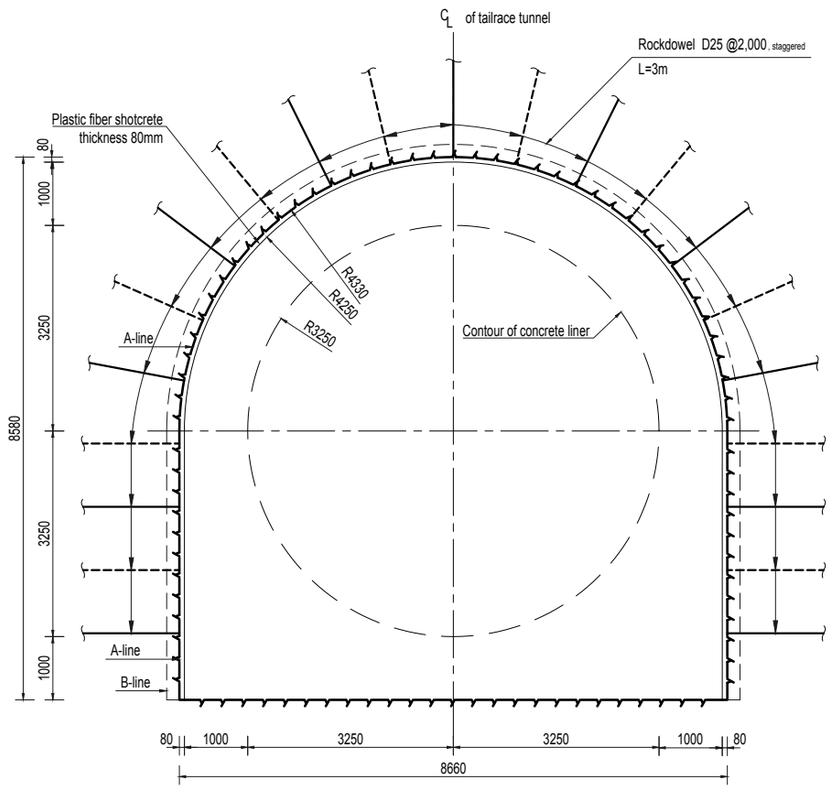
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-05	5 OF 7	0A

A1 (594 x 841 MM)

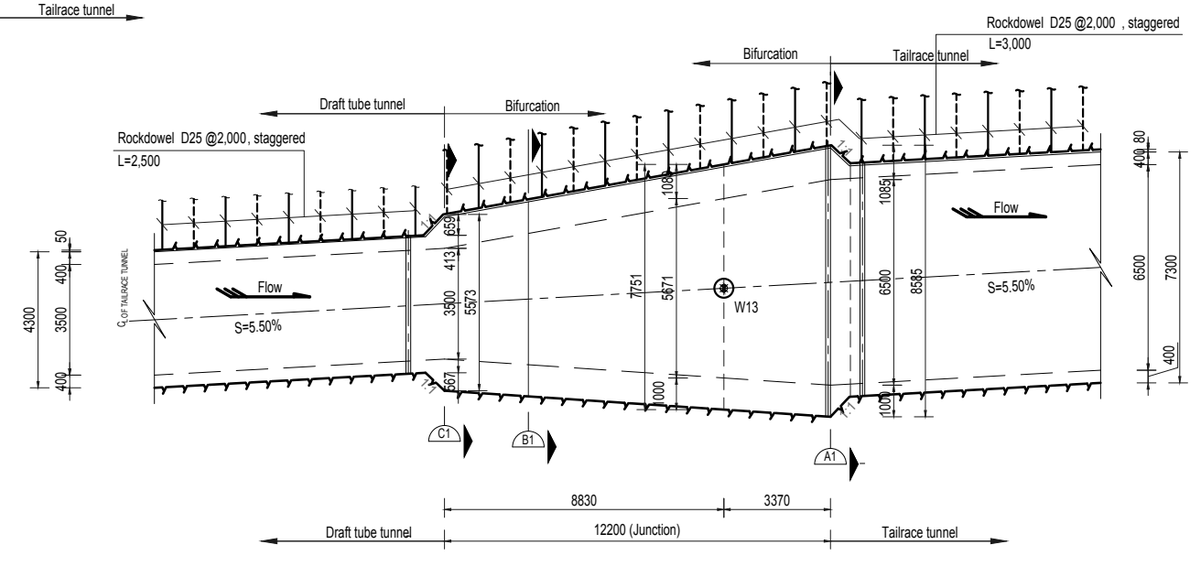
EXCAVATION PLAN FOR JUNCTION OF TAILRACE TUNNEL
Scale 1:100



SECTION A1-A1
Scale 1:50



PROFILE FOR JUNCTION OF TAILRACE TUNNEL
Scale 1:100



NOTE

1. This set of drawings are the excavation and support of tailrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 2.

Scale:

1:100 0 1 2 3 4 5m

1:50 0 0.5 1 1.5 2 2.5m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.G.

PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER

NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT. LTD.

OWNER'S ENGINEER

TRACTEBEL ENGIE jade CONSULT

CONTRACTOR

DOOSAN Doosan Heavy Industries & Construction

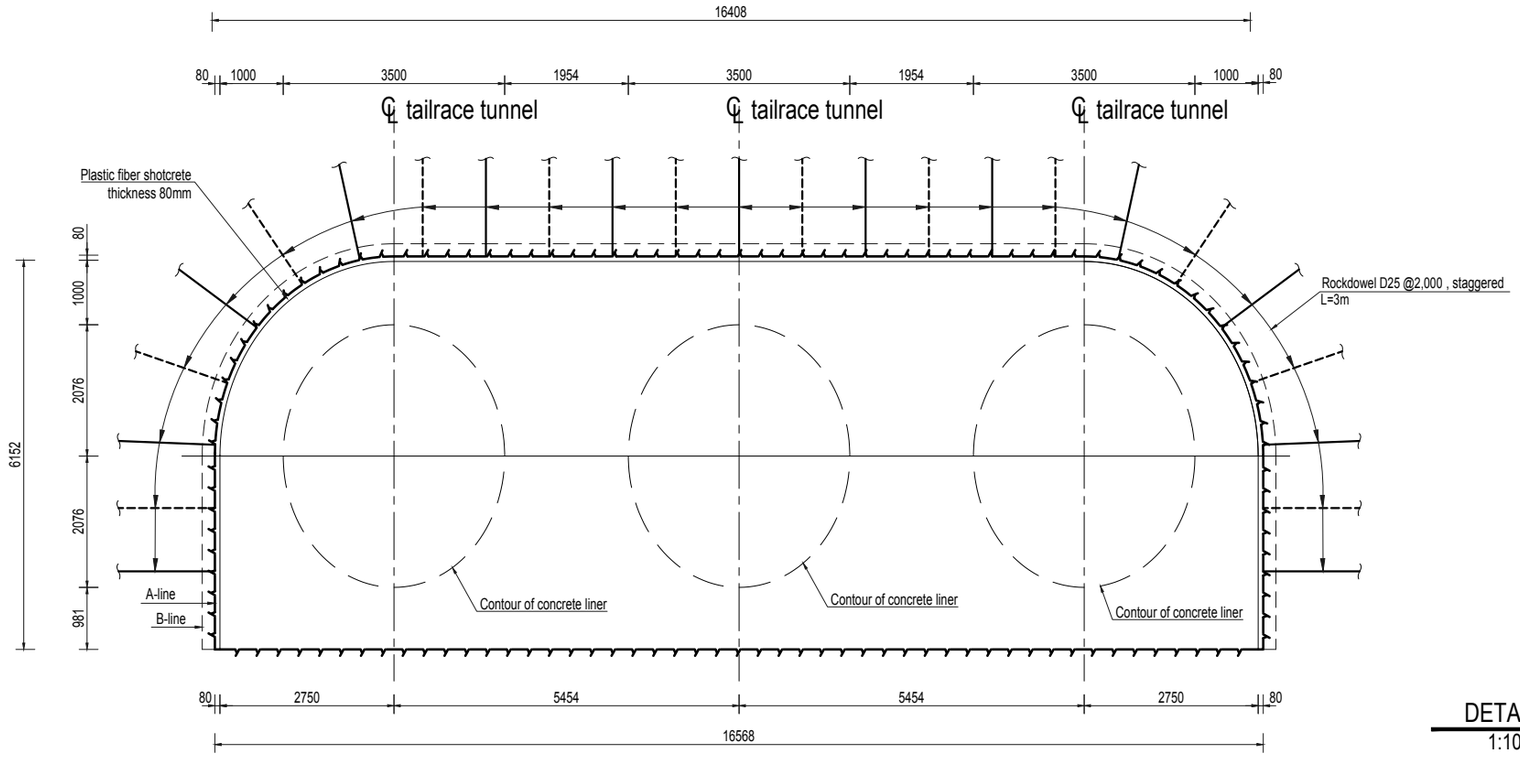
DRAWING TITLE

EXCAVATION AND INITIAL SUPPORT DRAWINGS OF TAILRACE TUNNEL(6/7)

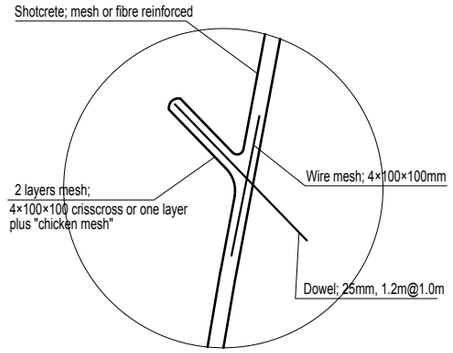
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-06	6 OF 7	0A

A1 (594 x 841 MM)

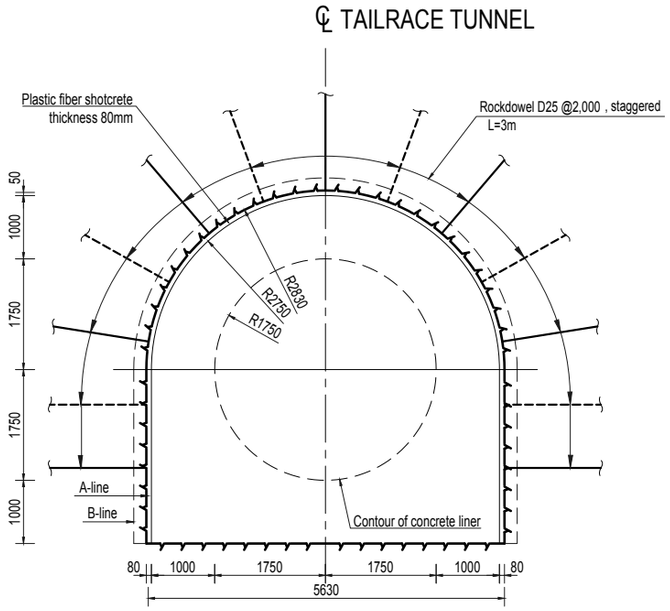
SECTION B2-B2
Scale 1:50



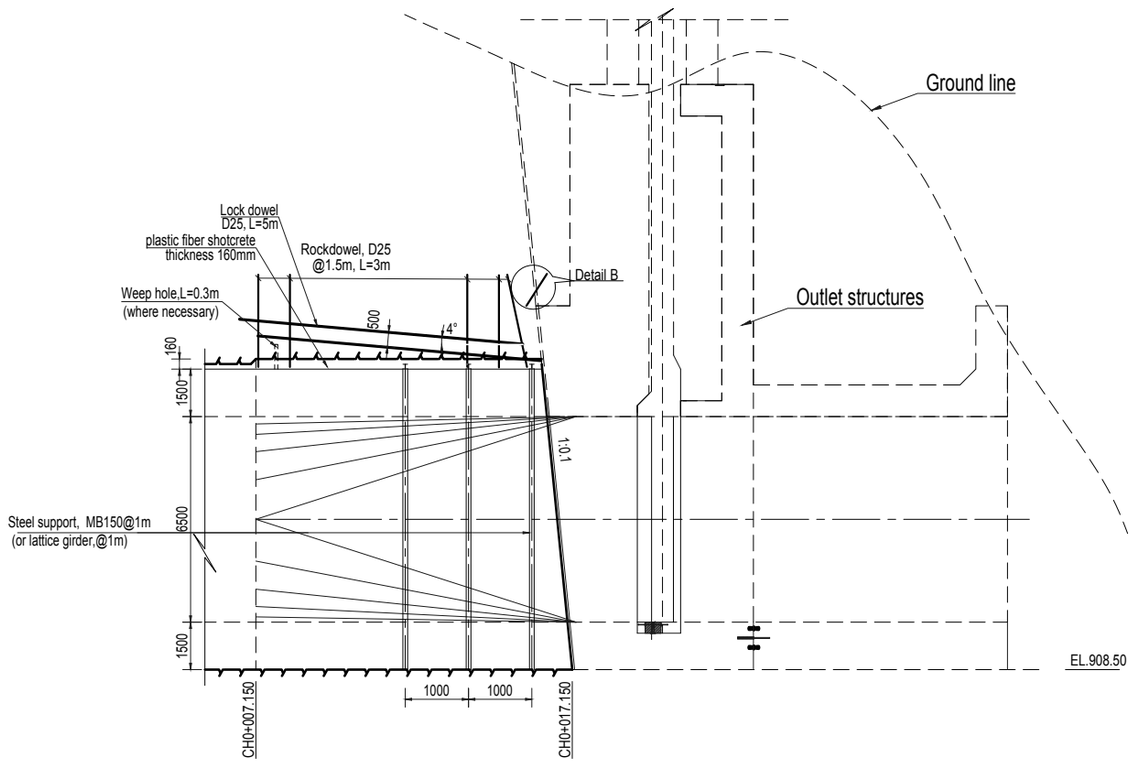
Detail B
1:20



SECTION C1-C1
Scale 1:50



DETAIL A
1:100



NOTE：The steel ribs at outlet are only required in rock class IV, number and distance of the steel ribs shall be determined by the site geological conditions.

NOTE

1. This set of drawings are the excavation and support of tailrace tunnel.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 2.

Scale:
1:50 0 0.5 1 1.5 2 2.5m
1:100 0 1 2 3 4 5m
1:20 0 0.2 0.4 0.6 0.8 1m

REFERENCE DRAWINGS

UT1-C-070-CVL-DG-59001	LAYOUT OF TAILRACE SYSTEM
UT1-C-080-CVL-DG-59001	EXCAVATION AND SUPPORT DRAWING OF TAILRACE OUTLET GATE CHAMMBER
UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN

SYMBOL AND LEGEND

FOR APPROVAL

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE PRELIMINARY FOR APPROVAL.
IT CAN BE CHANGED IN THE EXECUTION STAGE.
THIS DRAWING IS THE PROPERTY OF DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.
IT IS NOT TO BE COPIED OR USED IN ANY WAY DETRIMENTAL TO THE COMPANY.

REV. NO.	DATE	DESCRIPTION	DRAWN	CHKD.	APPD.
A	16.APR.,2022	FIRST ISSUE	ZHANG KAI	ZHANG J.Q.	ZHANG FAN LI W.G.

PROJECT TITLE
Upper Trishuli-1 HEP (216MW)

OWNER
NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT.LTD.

OWNER'S ENGINEER
TRACTEBEL ENGIE
jade CONSULT

CONTRACTOR
DOOSAN Doosan Heavy Industries & Construction

DRAWING TITLE
EXCAVATION AND INITIAL SUPPORT DRAWINGS
OF TAILRACE TUNNEL(7/7)

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-070-CVL-DG-59002-07	7 OF 7	0A

A1 (594 x 841 MM)